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PCT/IB03/05549
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Patentanmeldung Nr. Patent application No. Demande de brevet n°

02292997.0

PRIORITY DOCUMENT
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For the President of the European Patent Office

Le Président de l'Office européen des brevets
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Anmeldung Nr:
Application no.: 02292997.0
Demande no:

Anmeldetag:
Date of filing: 04.12.02
Date de dépôt:

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Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
Si aucun titre n'est indiqué se referer à la description.)

Image data display on an information carrier

In Anspruch genommene Priorität(en) / Priority(ies) claimed /Priorité(s) revendiquée(s)
Staat/Tag/Aktenzeichen/State/Date/File no./Pays/Date/Numéro de dépôt:

Internationale Patentklassifikation/International Patent Classification/
Classification internationale des brevets:

G11B/

Am Anmeldetag benannte Vertragstaaten/Contracting states designated at date of filing/Etats contractants désignées lors du dépôt:

AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LU MC NL PT SE SI SK

FIELD OF THE INVENTION

The invention relates to an information carrier intended to be put in a rotation motion.

The invention also relates to a player apparatus for playing such an information carrier.

The invention may be used in the field of optical disc for displaying a still image on a optical disc in a player apparatus.

BACKGROUND OF THE INVENTION

Information carriers such as optical discs comprise visual data mapped on the surface opposite to the reading surface. In particular, visual data may correspond to the label of the record or the table of content (TOC). These data are only visible by a user when the disc is not rotating.

The Japanese Patent published under number 11-250644 describes a disc player comprising means which allow to see the label of a disc when rotating. To this end, the player comprises means for flashing a label face once per revolution so that the label can be seen as an apparently still image by making the afterimage continuous. The property of the human eyes to integrate visual information is used.

The disc player as described in the prior art document has technical limitations.

The use of flashing means takes up a lot a space in the player, so that this solution cannot be used in consumer products such as disc players of reduced size.

Moreover, flashing means are power consuming.

Finally, using flashing means only allows to see an image that was previously printed on the disc.

OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to propose an information carrier allowing to display an apparently still image when rotating.

To this end, the information carrier comprises :

- display means for displaying image data,
- motion-compensation means applied to said image data, for motion-compensating said rotation motion.

The motion-compensation allows to cancel the effect of the rotation so that the displayed image is apparently still for a user looking at the disc player apparatus. Means for obtaining an apparently still image are directly put on the disc itself. Thus, such a solution no more needs flashing means, which allows to reduces the size of a player apparatus intended to play an information carrier according to the invention.

In a preferred embodiment, the information carrier comprises a memory device for storing said image data.

This memory device allows to store image data concerning the information carrier, such as for example the disc label, the TOC, or an image of the performer.

In a preferred embodiment, the information carrier comprises contact-less means for receiving said image data from an information carrier player apparatus.

This feature allows to personalize and to change the content of the displayed image on the disc. For example, a CD audio information carrier may receive coloured patterns changing according to the music, or any image data (or a sequence of image data) sent by the player apparatus.

In a preferred embodiment, the information carrier comprises calculation means for calculating the angular position of the information carrier, and/or contact-less means for receiving said angular position from an information carrier player apparatus.

The angular position of the display means is used for performing periodically the motion-compensation of image data for ensuring an apparently still image.

If the calculation means for calculating the angular position are implemented in the information carrier, the data exchange with the player apparatus is limited, which allows to decrease the complexity of such an apparatus. Moreover, it eases the use of information carriers according to the invention in existing player apparatus.

If the calculation means for calculating the angular position are implemented in the player apparatus, the cost of information carriers according to the invention is reduced.

In a preferred embodiment, the display means correspond to a pixel matrix organized according to a rectangular pattern.

In a preferred embodiment, the display means correspond to a pixel matrix organized according to a circular pattern.

In a preferred embodiment, display means correspond to a polymer LED display.

These displays allow to reproduce the content of image data while ensuring an easy addressing, and/or a thin thickness of the information carrier. If these displays correspond to LED displays (Light Emitting Diodes), or to LCD (Liquid Crystal Display), the power consumption is reduced significantly.

The invention also relates to an information carrier player apparatus comprising contact-less means for sending image data to an information carrier as previously described.

In a preferred embodiment, the player apparatus comprises calculation means for calculating the angular position of said information carrier, said angular position being sent to said information carrier by mean of said contact-less means.

Detailed explanations and other aspects of the invention will be given below.

BRIEF DESCRIPTION OF THE DRAWINGS

The particular aspects of the invention will now be explained with reference to the embodiments described hereinafter and considered in connection with the accompanying drawings, in which identical parts or sub-steps are designated in the same manner :

Fig.1 depicts an information carrier according to the invention,

Fig.2 depicts the processing means implemented in an information carrier according to the invention, and processing means implemented in the player apparatus according to the invention in which the information carrier is intended to be inserted,

Fig.3A depicts an information carrier according to the invention with a first type of display,

Fig.3B depicts an information carrier according to the invention with a second type of display.

DETAILED DESCRIPTION OF THE INVENTION

Fig.1 depicts the structure of an information carrier 101 according to the invention, said information carrier being intended to be put in a rotation motion. This information carrier corresponds for example to a CD Audio, a DVD, or any other optical disc.

The information carrier 101 comprises display means 102 for displaying digital image data. The display means 102, interdependent with the information carrier 101, are mapped on a surface of the information carrier 101 so that the reading operation performed by a laser beam is not disturbed.

The information carrier 101 also comprises motion-compensation means applied to image data, for periodically motion-compensating the rotation motion. Such motion-

compensation means are preferably implemented in a integrated circuit 103 placed at a position where the normal read/write operations of the disc are not disturbed. Advantageously, the integrated circuit is placed close to the central hole of the information carrier in order to avoid additional mechanical unbalance to the disc and to ease detection (e.g. optically) of the IC positioning (IC in charge of the display). A preferred location is between the information and clamping area of the information carrier.

The principle of the motion-compensation is to re-compute periodically, during the rotation of the information carrier, the coordinates of pixels (picture elements) composing the image data so that the pixels are apparently displayed at the same spatial coordinates for an external viewer.

For example, let consider at time T0 the display of pixel value P0 having coordinates (x0,y0) in the axis reference (x,y) associated to the display 102. At time (T0 + ΔT), considering the rotation of the information carrier at an angular speed ϖ rad/s, the reference axis (x,y) have rotated by an angle $\phi=\varpi.\Delta T$. The angle ϕ defines the absolute angular position of the information carrier 101. To display pixel P0 at the same apparent position, a transformation has to be performed on the coordinates (x0,y0) for determining the new coordinates (x1,y1) where the pixel P0 has to be displayed.

This transformation is a rotation by an angle $-\phi$ performed on the coordinates (x0,y0) that can be described by the following equations :

$$x1 = int(x0.\cos\phi + y0.\sin\phi) \quad \text{Eq.1}$$

$$y1 = int(y0.\cos\phi - x0.\sin\phi) \quad \text{Eq.2}$$

with int(Z) being the nearest integer value of Z, for getting integer coordinates.

This rotation transform can be described more easily if pixels to be displayed are expressed in polar coordinates (r,σ), where r is the radius, and σ is the angle from axis x. In such a case, the new coordinates (r1,σ1) of pixel PO(r0,σ0) are such that r1=r0, and $\sigma1=\sigma0-\phi$.

The motion compensation is advantageously performed to an integer multiple N of the disc rotation frequency, N being set so as to ensure a continuous apparently still image.

The display 102 may correspond to a pixel matrix being organized according to a rectangular pattern, as shown in Fig.3A.

Advantageously, the display 102 may correspond to a pixel matrix organized according to a circular pattern, such as shown in Fig.3B (with a limited number of pixel display elements to ease the understanding). This alternative is advantageous since the new pixels coordinates derived from the rotation transform can be directly expressed in polar coordinates, which eases the addressing.

In both cases, the display means 102 correspond to a LED display (light-emitting diode) having the characteristic to be thin, flexible, and of small mass. In particular, the display corresponds advantageously to Polymer LED display known as PolyLED display. A reflective Liquid Crystal Display (LCD) being thin and of small mass can also be used, but must be illuminated externally.

Fig.2 depicts the processing means implemented in an information carrier 201 according to the invention, and processing means implemented in the player apparatus 202 in which the information carrier 201 is intended to be inserted and played.

The information carrier 201 and the player apparatus 202 communicate by means of contact-less means 203 and 204. Contact-less means 203 are implemented in the player apparatus, while contact-less means 204 are implemented in the integrated circuit 205 (referred to as 103 in Fig.1) and/or at its periphery. Different technological approaches can be used for implementing such contact-less means :

- inductive approach : using alternating magnetic flux at a few MHz (preferably 13.56 MHz) sent by a coil implemented in the player apparatus, and received by a coil implemented in the information carrier,
- capacitive approach : using an alternating electrical flux of high voltages, and antenna plates in both the information carrier and the player apparatus,
- RF (radio frequency) approach : using Electro Magnetic radiation at high frequencies (a few GHz), with an antenna in the player apparatus, with or without an antenna implemented in the information carrier,
- optical coupling approach.

The integrated circuit 205 comprises a memory device 206 for storing the image data to be displayed on the display 207. The image data can be initially stored by the publisher of the information carrier (ROM memory may be advantageously used in this case), or received in real-time by contact-less receiving means 203-204 from the player apparatus (RAM memory may be advantageously used in this case). Image data can either be stored using Cartesian or polar coordinates. Image data can be either in a raw format (such as bitmap), or alternatively in a coded format (such as JPEG format). In this last case, the information carrier comprises decoding means (not represented) for decoding such coded image data.

Image data may correspond for example to patterns whose colours are changing according to the music played, or any other information intended to be looked at by a user (text, images, graphics, sequence of images, updated TOC).

The absolute angular position ϕ of the information carrier 201 can be determined by calculation means 208 comprised in the chip 205, or alternatively determined by calculation means 209 comprised in the player apparatus. In this last case, the angular position ϕ is sent to the information carrier by contact-less means 203-204 from the player apparatus. Different technological approaches can be used for determining the absolute angular position ϕ :

- optical detection of the position of the display 207 via the disc-read-out spot (optical marker at read-side of the information carrier),
- from the wobble addresses of the information carrier,
- optical detection of the position of the display 207 via extra detection means (optical or magnetic means used as a proximity detector),
- using the rotation motor tacho intended to put the information carrier in a rotation motion,
- using a one Pulse Per Rotation signal (1PPO) obtained by on-chip or on-display detection means, e.g. a photo-diode detecting a stationary light spot.

The motion-compensation means 210 are applied to image data stored in memory 206. Motion-compensation means 210 correspond in particular to code instructions of a software program executed by a signal processor embedded in the chip 205. The motion-compensation means 210 receive absolute angular position ϕ to perform the rotation transform on image pixels to be displayed, as well as a clock signal CLK indicating at which frequency f such a rotation transform has to be performed ($f = 1/\Delta T$).

Once all the new coordinates of pixels are computed by motion-compensation means 210, the pixels are sent to a display driver 211 in charge of driving the display 207 (addressing operation, data buffering ...).

The power supply VCC of all processing and display means implemented in the information carrier 201 is supplied by contact-less means 203-204, or by an on-disc battery.

In case the information carrier is not rotating, but still receiving energy by contact-less means, the image is displayed in a traditional way, that is to say without performing a motion compensation on image data. In the case the information no more receives energy by contact-less means (i.e. power is removed), it can be advantageous to use a display 207 having the characteristic of retaining the image information. Such a display is known as "electronic paper".

In case the information carrier is fully covered by the display, it may be hard to see that the information carrier is rotating and that the player apparatus is in a reading or writing operation. Therefore it may be advantageous to add a visible mark to the information carrier, such as a dot/line/shape placed at a certain angular position. When rotating, this mark appears

optically continuous, while when the display is switched off, the mark is clearly visible on the information carrier.

CLAIMS

1. Information carrier intended to be put in a rotation motion, said information carrier comprising :
   - display means for displaying image data,
   - motion-compensation means applied to said image data, for motion-compensating said rotation motion.

2. Information carrier as claimed in claim 1 comprising a memory device for storing said image data.

3. Information carrier as claimed in claim 2 comprising contact-less means for receiving said image data from an information carrier player apparatus.

4. Information carrier as claimed in claim 3 comprising calculation means for calculating the angular position of the information carrier, and/or contact-less means for receiving said angular position from an information carrier player apparatus.

5. Information carrier as claimed according to one of claims 1 to 4 where display means correspond to a pixel matrix organized according to a rectangular pattern.

6. Information carrier as claimed according to one of claims 1 to 4 where display means correspond to a pixel matrix organized according to a circular pattern.

7. Information carrier as claimed according to one of claims 1 to 6 where display means correspond to a polymer LED display or to a LCD display.

8. Player apparatus for playing an information carrier, said player apparatus comprising contact-less means for sending image data to an information carrier as claimed in claim 1.

9. Player apparatus as claimed in claim 8 comprising calculation means for calculating the angular position of said information carrier, said angular position being sent to said information carrier by mean of said contact-less means.

"Image data display on an information carrier"

ABSTRACT

The invention relates to an information carrier 101 intended to be put in a rotation motion, said information carrier comprising :

- display means 102 for displaying image data,
- motion-compensation means applied to said image data, for motion-compensating said rotation motion.

Use : Optical disc / Optical disc player

Ref : Fig.1

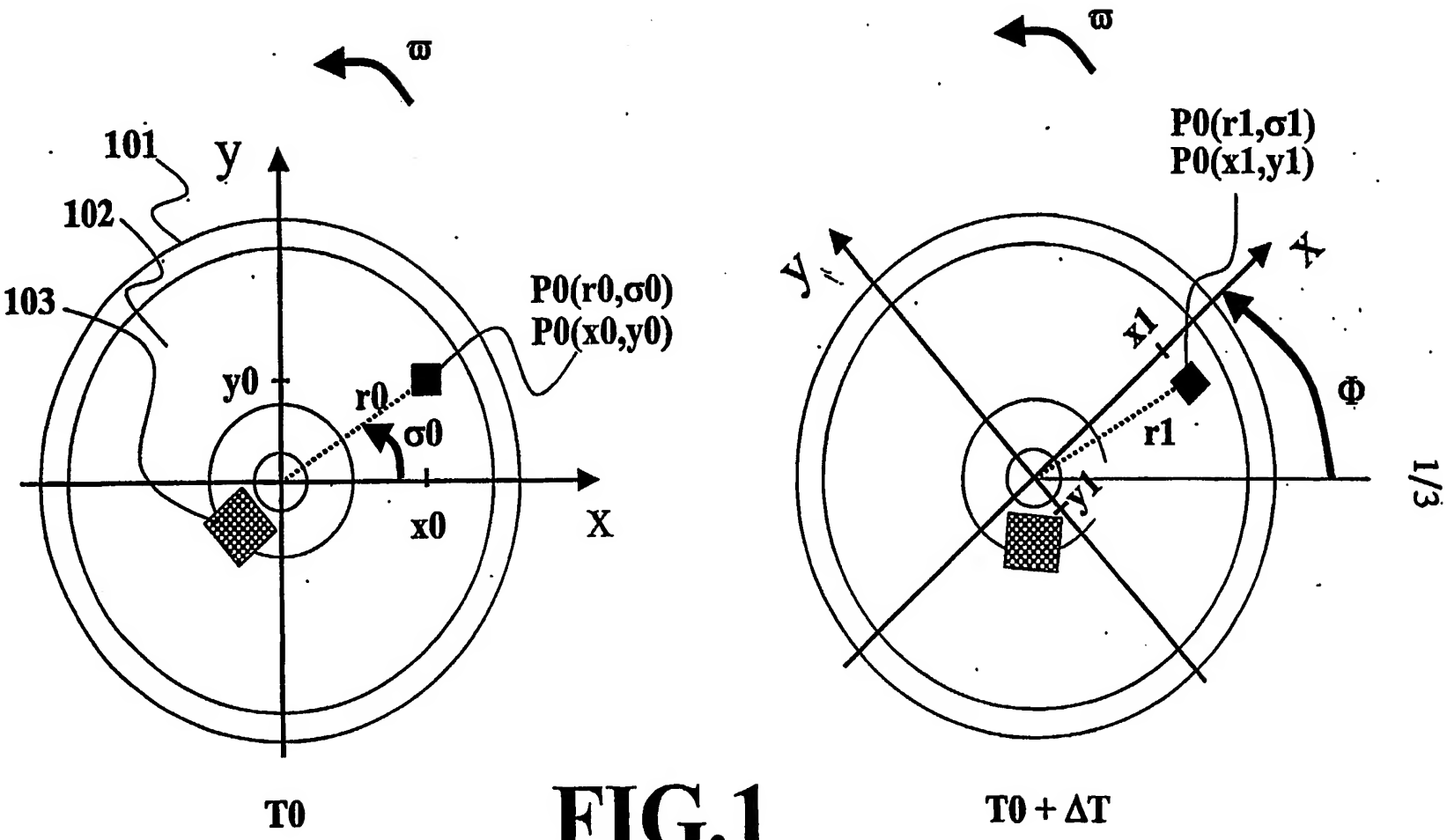
ϖ
101
y
102
103
P0(r0,σ0)
P0(x0,y0)
y0
r0
σ0
x0
X
T0
ϖ
P0(r1,σ1)
P0(x1,y1)
y
x
x1
Φ
r1
y1
T0 + ΔT

FIG.1

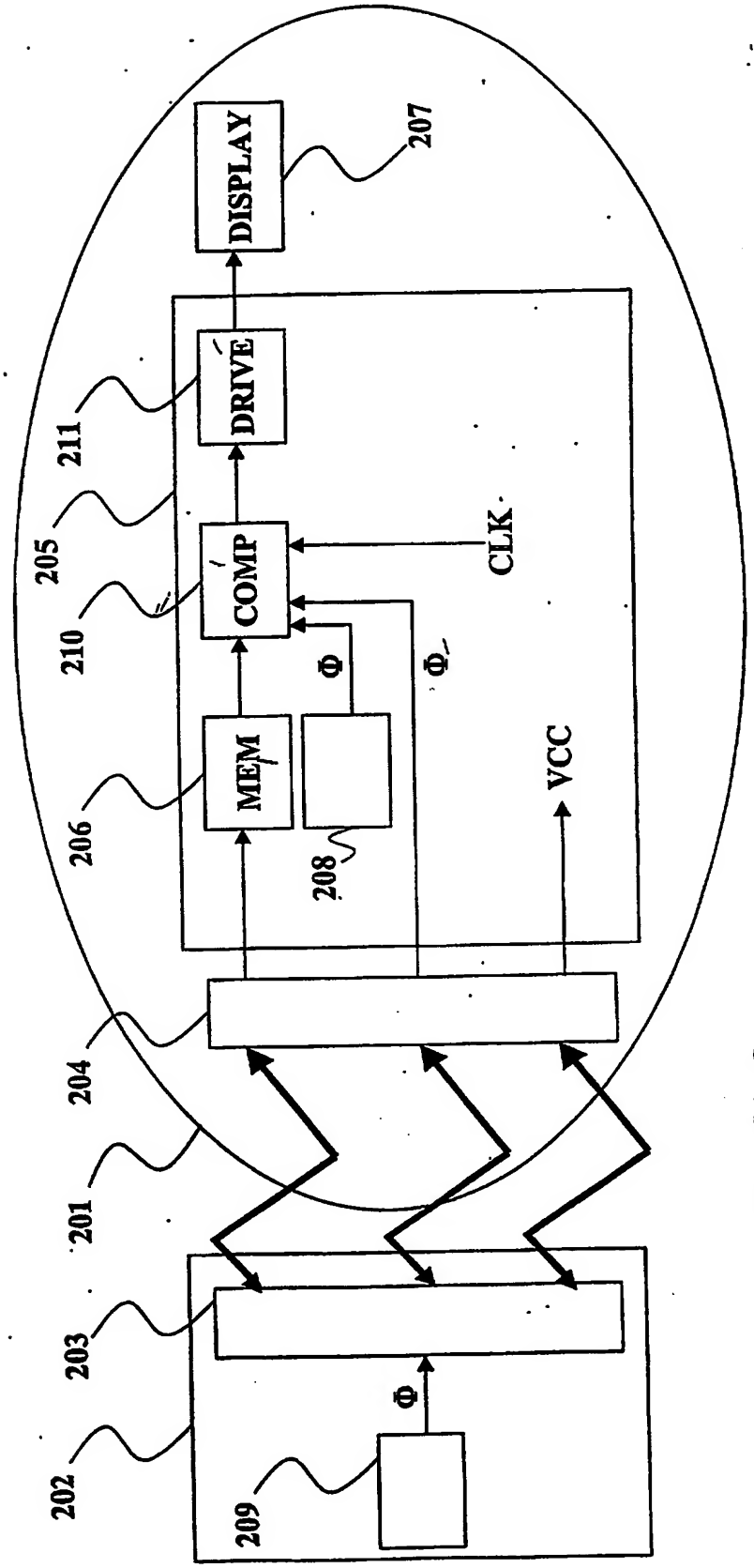
DISPLAY
207
DRIVE
211
205
COMP
210
CLK
Φ
Φ
MEM
206
208
VCC
204
201
203
Φ
202
209

FIG.2

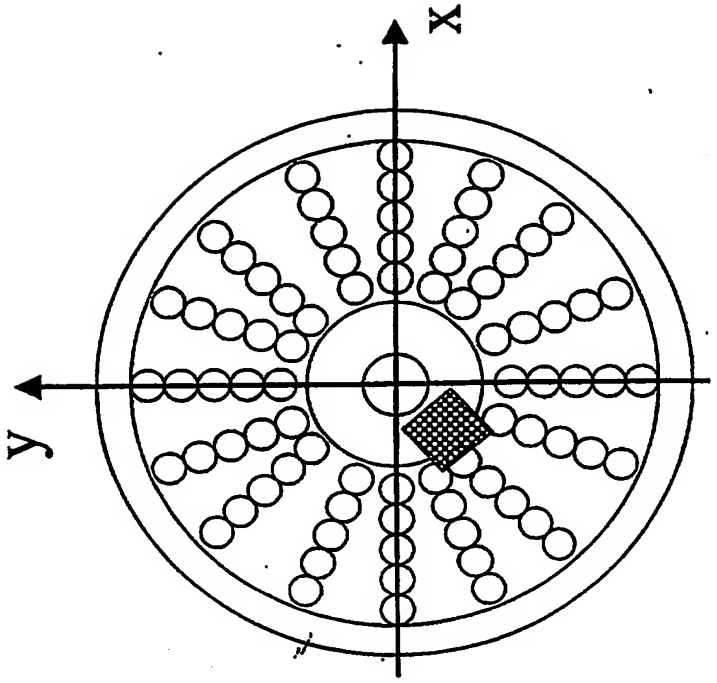

FIG.3B

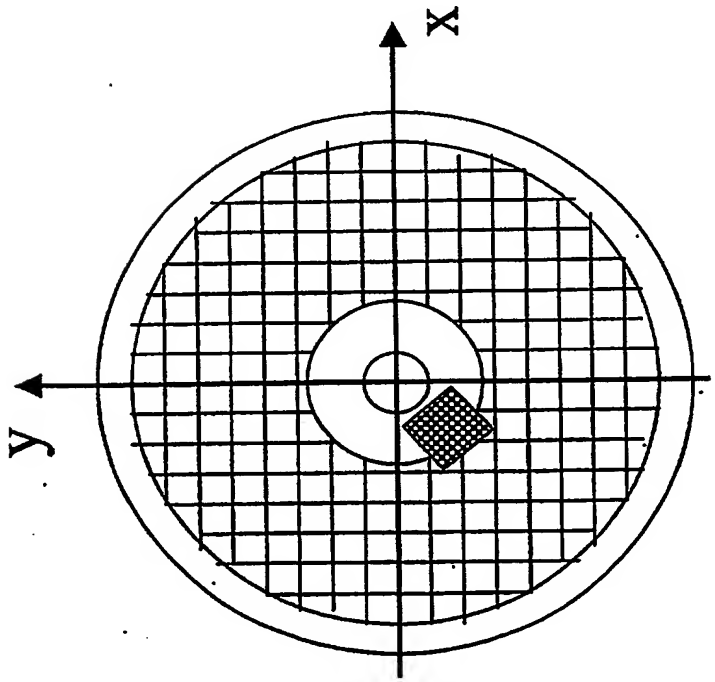

FIG.3A